DOCUMENT RESUME

ED 198 960 PS 012 122

AUTHOR Elbers, Loekie
TITLE Cognitive Principles of Babbling: A Case Study. Report 21.
PUB DATE Feb 80
NOTE 30p.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Case Studies; *Child Language; *Cognitive Development; *Concept Formation; *Developmental Stages; Foreign Countries; *Infant Behavior; *Language Acquisition; Language Research
IDENTIFIERS Continuity; *Netherlands; Vocalization

ABSTRACT

A case study of the period of repetitive babbling in one Dutch infant is reported. Repetitive babbling is seen as a systematic and continuous process, during which the child is applying certain strategies in order to form concepts concerning the possibilities of his or her articulatory apparatus. Strategies identified are: (1) variation strategies, which consist of the systematic varying of an articulatory dimension, and (2) combination strategies, consisting of the combining of articulatory acts which previously have been exercised separately. Three stages are distinguished in the development of repetitive babbling. In the first stage the articulatory dimensions of "voice" and "closure" are discovered and their interrelationships are investigated. Babbling proceeds from vocalization to repetition. In the second stage the dimension of "duration" is varied and the effects of this variation on "voice" and "closure" are observed. Concatenations appear after repetitions in babbling. In the third stage the articulatory dimensions of "place of articulation" and "stress" are systematically investigated. Some global imitative tendencies may arise. Mixing and differentiation of babbles occur after concatenation and repetition. The subsequent stages of jargon babbling and first words are briefly discussed and their continuity with repetitive babbling is pointed out. Objections to a continuity approach to babbling are critically discussed and some areas for future research are indicated. (Author/RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED198960

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

COGNITIVE PRINCIPLES OF BABBLING: A CASE STUDY

Loekie Elbers
Psychological Laboratory
University of Utrecht
Varkenmarkt 2
3511 BZ Utrecht, Holland

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Loekie Elbers

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

February 1980

REPORT 21

PS012122

Abstract

A case study of the period of repetitive babbling in one child (Dutch) is reported. A cognitivistic analysis is presented, based on observations of "behavior involving the articulatory organs", including types of babbles and their order of appearance.

It is argued that repetitive babbling is a systematic and continuous process, during which the child is applying certain strategies in order to form concepts concerning the possibilities of his articulatory apparatus. Two types of strategies identified are: variation strategies which consist of the systematic varying of an articulatory dimension and combination strategies consisting of the combining of articulatory acts which previously have been exercised separately.

Three stages are distinguished in the development of repetitive babbling. In the first stage the articulatory dimensions of "voice" and "closure" are discovered and their interrelationships are investigated. Babbling proceeds from vocalization to repetition.
In the second stage the dimension of "duration" is varied and the effects of this variation on "voice" and "closure" are observed. Concatenations appear next to repetitions in babbling.
In the third and last stage the articulatory dimensions of "place of articulation" and "stress" are systematically investigated. Some global imitative tendencies may be suspected to arise. Mixing and differentiation of babbles occurs, next to concatenation and repetition.

The subsequent stages of jargon babbling and first words are discussed shortly and their continuity with repetitive babbling is pointed out.

In the Discussion objections against a continuity approach of babbling are critically discussed and some areas for future research are indicated.

Cognitive principles of babbling: a case study

1. Introduction

If one lives with an infant who is babbling repetitively (i.e. is vocalizing repetitively in CVCV-like sound clusters like "bababa" and "dadada"), the question "what in fact is the child doing" arises naturally. Upon consulting the babbling literature however, one notices that the suggested answers either seem to be beside the point or too unspecific to be of much interest. Summarized very briefly the existing babbling theories run as follows.

Learning theory (Mowrer, 1952, Winitz 1966) holds that the child is trying to select a repertoire of sounds which resemble those of his caregivers, since the sounds produced by these important persons have a reinforcing value.

Maturational theory (Lenneberg 1967) on the other hand views babbling primarily as the result of biological maturation. Infants do not babble because they want to resemble their parents but because they are biologically determined to babble. Babbling is a side-effect of maturation and serves no specific purpose in language development. The period may be skipped without detrimental effect for future speech acquisition.

Learning theory and maturational theory not only give different answers to the question of "why" infants babble, but also to the question of "how" the babbling process proceeds. Learning theory holds that infants select speech sounds from an initially very large set of randomly produced vocalizations ("all the sounds of all languages"). Babbling in this way gradually merges into early speech. This view is termed the "continuity approach" by Clark & Clark (1977). Maturational theory emphasizes the random character of the babbling sounds throughout the whole period of babbling (see Lenneberg 1967, p. 276-280). If developmental trends occur during babbling they are essentially irrelevant to the subsequent acquisition of speech sounds during early speech. Clark & Clark (op.cit.) call this view the "discontinuity approach". Lenneberg, one of the best known proponents of this approach, does not accord a special status to repetitiveness in babbling. In fact he hardly mentions this characterisitic aspect (Lenneberg op.cit.).

Jakobson, another well known proponent of the idea of discontinuity seems to regard repetitiveness primarily as a characteristic of early speech but not of babbling when he says that repetition is "a compulsory process signaling that the uttered sounds do not represent a babble, but a senseful, semantic entity" (Jakobson 1971, p. 25).

The naïve observer of a babbling infant is somewhat baffled by the above mentioned theories. For he sees a child whose endless repetitions of the same soundcluster certainly do not suggest randomness of articulatory movements. Also, these soundclusters certainly do not seem to have a specific meaning, nor do they seem to be a simple imitation of adult speech sounds.

However, it is not only on intuïtive grounds that the existing theories appear to be unsatisfactory. Clark & Clark (op.cit.), in their discussion of continuity and discontinuity approaches, conclude that neither approach can successfully accommodate all the known facts of babbling. The continuity approach cannot explain why children in the early stages of language acquisition often appear to be unable to produce certain sounds which they used frequently in babbling. The discontinuity approach cannot explain the phenomenon of "babbling drift" (Brown 1958), i.e. the fact that babbling gradually begins to sound like the mother tongue, and the fact that similarities appear to exist between the soundclusters produced in babbling and those produced in early speech (Cruttenden 1976; Oller, Wieman, Doyle & Ross 1976).

In this article I will approach babbling from a point of view which may be called "cognitivistic" in that it sees the infant as a creature trying to form concepts. A cognitivistic approach does not deny that biological determination exists, nor that behavior may be reinforced by external rewards; it simply emphasizes another aspect of human development, which is that growing up implies acquiring conceptual knowledge. Of course, the cognitivistic approach is not new at all and has been used in several areas of language development research. One may look, for example, at the grammars that have been written for early speech (Bloom 1970, McNeill 1970, Brown 1973, Schlesinger 1971), at the interesting study of Weir (1962) concerning "bed time monologue's", or at the steadily growing body of research into the development of concepts of communicative interaction (Snow & Ferguson 1977, Waterson & Snow 1978, Schaffer 1977).

However, a cognitivistic analysis of babbling behavior has hardly ever been undertaken (but see Gruber 1971 for an attempt).

My cognitivistic analysis will be based on the assumption that during the babbling period the child is acquiring conceptual knowledge concerning the possibilities of his vocal apparatus. The question then becomes one of characterizing this knowledge and of describing the ways in which it develops. This way of formulating the goal of babbling research makes one point very clear; all kinds of behavior involving the articulatory organs will have to be considered, not just those behaviors which are "speech-like". So "acts" or "games" like holding the breath intentionally, blowing, protracting the tongue, vocalizing with some object in the mouth etc. are just as relevant as clear-cut babbles since they too involve the articulatory organs. In my analysis observations of such "non speech" activities will play a very important part.

The research to be reported is a case study of the period of repetitive babbling in one child (i.c. my own son Thomas). I chose repetitive babbling for several reasons. Firstly, while repetitiveness is generally considered to be one of the most striking characterisitics of prelinguistic vocalization, still very little is known about developmental trends in repetitive babbling. Secondly, as soon as the child starts to repeat himself we may, given a cognitivistic approach, suspect that he is beginning to explore his articulatory organs more or less consciously and intentionally. Thirdly, the very repetitiveness of the vocalizations makes it easier for the listener to globally classify them into categories of sound.

I will argue that repetitive babbling is a systematic and continuous process showing clear developmental trends. The child seems to be systematically exploring the following dimensions or aspects of articulation; Voice, Closure, Duration, Place of articulation and Stress. Also, I will try to elucidate in what way repetitive babbling gradually takes on characteristics which may be regarded as preparatory for the subsequent phases of "jargon" babbling and early speech. With respect to the strategies used by the child, I will argue that the principal operating principles seem to be the combination strategy of combining articulatory acts which previously have been performed in isolation, and the variation strategy of varying an articulatory dimension and observing "what happens".

2. Method

Thomas' period of repetitive babbling began at ± 6 month's and lasted until he was about 11½ month's old, at which time jargon babbling (no clear repetitions but sentence-like intonation patterns) began to be introduced. His first words appeared when he was 15½ month's old.

During the five month's of mainly repetitive babbling I taperecorded his productions on at least two different days of the week, but mostly on three different days. Twice there were periods in which he was ill and did not babble. At first, recording was done mainly in the context of diaper changing, but later mostly when he was playing in his play pen or sitting in his baby chair while I was somewhere near doing housework. Over the whole period I collected 11 hours of tape. In transscribing the tapes I simply took the attitude of a Dutch native speaker listening to someone who is producing nonsense. In other words, my "etic" categories of description were based primarily on my competence as a native speaker. These etic categories of course are not as refined as those of a phonetically trained observer. However, as the following analysis may show, they seem to be sufficiently detailed for arriving at a tentative description of some "emic" categories underlying infant babbling behavior.

I also noted where primary stress appeared to be placed. I did not bother about describing other aspects of intonation, since this seemed to be too complex a job to do without sophisticated apparatus.

In analysing the data I defined a babble as a sound or a sequence of sounds produced in one stretch, and a babbling sequence as a series of babbles preceded and followed by a relatively long silence.

Non speech activities involving the articulatory organs I noted down as I happened to observe them.

My interpretation of the data will be based on the assumption that recurrent patterns within babbles, babbling sequences and non speech activities may shed light on the concepts the child is trying to attain. The way in which different recurrent patterns follow one another over time may provide insights into the strategies or operating principles the child is using in his process of concept formation.

3. Data and Interpretation

A survey of all types of babbles appearing during the whole period of repetitive babbling is given in Table 1. Tables 2, 3, 4, 5 and 6 provide examples of transcriptions of recorded babbling episodes or of parts of them.

In interpreting the data I delineate three stages in the period of repetitive babbling. During the first stage the child proceeds from mere vocalizing to repetitive babbling in a CVCV-like pattern. During the second stage concatenations appear next to repetitions. The third stage shows differentiation and mixing of babbles in addition to repetition and concatenation.

3.1. Stage 1: Establising Voice and Closure; from vocalization to repetition

In the weeks before the first clearcut repetitions of CVCV character appeared, Thomas frequently produced four recognizeable kinds of vocalizations: loose vowels /ɑ/ and /ə/ and two "consonantal" productions sounding like /bvv / and a guttural /ɣɣɣ/. He also uttered a sequence of sounds which I called "vowel stammering". This consisted of a series of short staccato ah-ah-ah-ah sounds separated by glottal stops. Vowel stammering appeared to be a favorite pastime which continued well into the second month of repetitive babbling.

I think vowel stammering may be considered as the first repetitive babble, since it consists of a first attempt at producing the same sound over and over again on the same breath.

A specific non speech activity accompanied the appearance of vowel stammering, namely "holding the breath". Although at the time I was mainly wondering what the child was trying to do to himself, it now does not seem remarkable that the breath should be held intentionally, since the child has much experience in doing it unintentionally when he is relieving himself, when he is crying angrily and when he is swallowing. Also, the relationship with vowel stammering is obvious: holding the breath may be regarded as a prolonged glottal stop and glottal stops (also slightly prolonged) are used in vowel stammering. So we see that now two acts which are also performed in isolation are combined into one act; vibrating the vocal cords (found in the "loose" productions) and closing the vocal fold (found in "holding the breath").

This suggests that the child by this time is in the process of arriving at two concepts: a concept of "Voice" (phonating) and a concept of "Closure" (actively and completely obstructing the stream of air). These concepts however, are not yet fully distinct, since they are mutually exclusive. In vowel stammering the presence of Closure coincides with the absence of Voice and vice versa[1)]. So the two concepts still have to be disentangled. In fact, this seems to be what occurred next.

When he was 6½ month old, Thomas' first repetitive babble with a "conventional" CVCV character appeared, i.e. / gaga / etc. Except for vowel stammering these / gaga / sequences were the only repetitive babbles during the following month. They were produced with great effort and much pressure on the throat. Incidentally the loose productions continued to appear and also there were occasional /baba/'s, but these were much less frequent than the / gaga / sequences. Toward the end of this month however, when he was 7½ month of age, Thomas began producing series of aspirated vowels sounding like he, he, he or ha, ha, ha. These series could be quite long and each aspirated vowel was produced on a separate expiration of breath. During one particular babbling episode he regularly alternated between such a series of aspirated vowels and "panting", a non speech activity which consisted of breathing in and out in a rythmical and noisy but voiceless way. So it appears that the "topic" of this particular babbling episode was the presence and absence of Voice.

In evaluating these facts the most plausible interpretation is that the child is trying to establish the limits of the dimensions of Voice and Closure and in so doing is disentangling these concepts from one another. He now seems to have arrived at the idea that when there is no Closure thereeither may or may not be Voice("aspirated vowel series" versus "panting") and when there is Closure there also may or may not be Voice ("/ gaga /" versus "holding the breath").

In summary, during this first stage of repetitive babbling the child has exhibited several kinds of behavior involving the articulatory organs, which suggest that he as acquired some knowledge of two articulatory dimensions, i.e. Voice and Closure, and of their relative independency. These kinds of behavior are: series of aspirated vowels which are + Voice - Closure, "Vowel stammers" and / gaga /'s which are + Voice + Closure, "panting" which is - Voice - Closure, and "holding the breath" which is - Voice + Closure.

3.2. Stage 2: Investigating Duration; from repetition to concatenation

A month after / gaga / had appeared for the first time, / baba / began to be produced frequently. A few weeks later the same was done with / dada /. These different babbles were not produced in any systematically related way, so the only thing we might tentatively conclude is that the child may be in the process of noticing that Closure can be brought about in several different ways, without explicitly contrasting these different ways. Repetition, to be exact, could in all cases consist of a series of syllables produced connectedly (babababababa ... etc.) or a series of single instances (abā, abē, bā, bē, etc.). In these single instances stress almost always occurred on the last vowel. Consonants could sometimes be unvoiced (babapa, datata, etc.). Since voiced consonants, however, were greatly in the majority and since there appeared to be no system in the appearance of unvoiced ones I will always use the symbol for the voiced consonants in referring to these babbles.

At approximately 8 month's the babbles / bvv / and / ggg / that had appeared incidentally during stage 1. began to be produced more frequently and repetitively, and new variants were introduced: / kxxx / (approximately the same sound as / ggg / but without voice), / pff / (during which the lips were forcefully pressed together and air was forced outwards), / dzz /, and a pure bilabial trill (brr). At about the same time that / dada / appeared, nasal consonants were produced for the first time in a repetitive way, / mama / and / nənə /.[2)]
The non speech activities of Thomas in this period were many and varied. I noticed "blowing", which may also be regarded as producing a pure and prolonged (fff); silently moving the jaw so that upper and lower lip just touched; attempts at protracting and retracting the tongue; gurgling; yodeling; vocalizing with the fingers or a plaything in the mouth, and an activity which I named "Indian call" in which he hit his mouth repeatedly with the back of one hand while at the same time producing a vowel.

At 9 month's sequences like / gax / and / bapf / began to be produced frequently (see Table 3 and Table 4). Also / daz / could be heard, but this babble was very infrequent on the recordings. Other new sequences to be noticed were / bwa /, which could also appear connectedly (bwabwabwa etc.), and / dzza /. Also / kxa / or / gga / could be produced, but these babbles only appear incidentally on the recordings in this period.

With respect to the loose vowels it was striking that they either could be very short (/ɑ/, /ə/, etc.) or very long (/ɑ:ɑ:ɑ:/). The long vowels generally displayed quite extreme variations in pitch, and were also used for yodeling.

We may interpret what is happening during this period als follows. In the previous stage the child has established the existence of the dimensions Voice and Closure. He knows they may be present or absent independently. He now begins to investigate the dimension of Duration. The child tries to make a closure "last", for instance he tries to produce a prolonged /bbbb/ or /dddd/. In so doing he produces babbles like /bvv/, /dzz/, /pff/, /kxx/, /gɣɣ/ and the bilabial trill. He tries to make a perfectly short closure by opening and closing his lips as lightly as possible, so that either nothing at all can be heard or a sequence of very light /p/ sounds. Varying the duration of Voice results in drawn out /ɑ:ɑ:/'s or staccato /ɑ/'s respectively. See for an example Table 2, which represents a babbling episode in which little else seems to be done than the varying of the duration of Voice and Closure.

In the course of these operations of lengthening and shortening the child may gradually notice that the effects on Closure and Voice differ. While the effect of lengthening on Closure is some qualitatively different sound, which also"feels" different since closure becomes incomplete, this is not so when Voice is lengthened. While the effect on Voice is some sound that may easily carry a maximum of intonational differences, this is not the case when Closure is lengthened. So the concepts which the child has of the dimensions Voice and Closure are growing still further apart. He now seems to be differentiating the concept of Closure into "short, complete Closure" and "prolonged, incomplete Closure". Both subconcepts remain distinguished from the concept of Voice.[3)] Additional support for this interpretation may be found in several of the non speech activities, in which the child seems to be experimenting with the two subconcepts of Closure in connection with Voice: "Indian call" (short complete closure + voice) may be contrasted with "vocalizing with fingers in mouth" (prolonged, incomplete closure + voice), "lightly moving jaw and in so doing producing small /p/-like sounds" (short, complete closure and no voice)

may be contrasted with "blowing" (prolonged, incomplete closure and no voice).

Towards the end of stage 2 different types of babbles no longer are merely repeated but are concatenated as well, so that more complex babbles are produced. Concatenation may be seen to be operating in the sequences /bɑpf/ and /gɑx /, which seem to be a chaining of the previously discrete babbles /bɑ/ + /pf/ and /gɑ/ + /x/. Also, the sequences /bwɑ/ and/dzɑ/ may be considered a chaining of the previously discrete babbles /bvv / + /ɑ/ and / dzs/ + /ɑ/. Note that for instance "prolonged, incomplete closures" have acquired some freedom of position; they may occur first (/bwɑ/) or last (/bɑpf/). This may suggest a growing consciousness of interchangeability.

In summary by the end of stage 2 the original concept of Closure seems to have differentiated into two subconcepts; short, complete closure and prolonged incomplete closure. The strategy used in discovering these subconcepts has been the systematic varying of the dimension of Duration (in stage 1 we saw this variation strategy applied to presence/ absence of Voice). Next to repetition, concatenation of separate babbles begins to take place. Concatenation may be considered as a new instance of the child's tendency to combine different acts into one act, as soon as the separate acts have been practiced sufficiently (in stage 1 we saw this combining strategy operating in "vowel stammering").

3.3. Taking off for talking; from concatenation to differentiation and mixing

The last stage of repetitive babbling started with two new babbles; /bùgəbùgə/ etc. and /dlɑdlɑ/ etc. /bùgəbùgə/ may be considered as the concatenation of the previously discrete babbles /bə/ and /gə/, and is the first babble in which place of closure is varied systematically. This suggests that a new articulatory dimension is being explored which may be called "Place of articulation". The babble /dlɑdlɑ/ obviously cannot be the result of a concatenation of separate babbles like /də/ and /lɑ/, since /lɑ/ had not occurred before. /dlɑ/ seemed to arise from the already existing babble /dzzɑ/.

In the babbling sequences of this period the next type of babbling sequence appeared more than once: ədz̀z, ədz̀z , ədzzɑ̀, ədz̀z , hədzɑ̀, hədlɑ̀(...) i.e. /l/ sounds were introduced in the context of /dz/ sounds.

So the discovery of "Laterality", the possibility of lateral movement of the tongue, may seem to be quite accidental. However, this discovery cannot be regarded as totally unexpected since silent tongue excercises had been going on for quite some time (see stage 2). Furthermore, one of the few new non speech activities introduced in stage 2 was "clicking with the tongue" (the others were "wispering" and "rounding the lips").

Some time after /bügəbügə/ and /dladla/ had been introduced, the by now well known combining strategy seemed to be applied again, and /dləgàjdləgàj/etc. began to be produced repeatedly. In this babble there is lateral movement of the tongue as well as variation of "Place".

A striking thing about the way in which the two babbles /bügəbügə/ and /dləgàjdləgàj/(i.e. the babbles in which "Place" was systematically varied) were eventually produced needs to be mentioned. Each babble could have several "variant forms", in which a tendency for smoothening the course of movement and in so doing producing more continuous sounds could be discerned. So for instance /bügəbügə/ could be transformed into /bügəmbügəm/ and eventually into /mɛŋəmɛŋə/. Likewise /dləgàjdləgàj/ could turn into /liajliaj/. It is not likely that this smoothening effect must be explained as the accidental byproduct of a tendency to speed things up. In the previous stage the babbling sequences also were sometimes produced at high speed, but they nevertheless maintained their non continuous character. Maybe we here see the lengthening/shortening strategy of stage 2 in a new disguise. Be that as it may, the fact rests that this smoothening of movements causes the babbles to acquire a quite fluent character.

As may be seen in Tables 5 and 6 the babbles /bügəbüg/, /dladla/ and /dləgàjdləgàj/ each were produced in a highly repetitive way. Also, /bu:wa/, appearing frequently some time later, was often produced in succession. However, the other babbles frequently uttered in this period tended to appear more or less "on their own", i.e. non repetitively, as one individual babble in a series of several different babbles. An example of such a series of individual babbles is: ə ,a, a, ba, bəx ,bàba, bügəbügə, hədà, həww , bu: , bu:, www . New babbles that appeared frequently in such an individualized way were /bu:/, /wa/, /ww /. Also, new concatenations occured in this individual fashion, of which /bügəmbvv/ was about the most frequent. However, /bəx/, /məx /, /bəgàx/, /bwagàx/, /bababvv/, /ax /, /kxa/, /gagə/ also appeared.

In stage 1 the combination strategy resulted in repetitions of the same babbling syllable. In stage 2 this strategy resulted in repetitions of concatenated syllables. Now in stage 3 one gets the impression that the monotony of the repetitive babbles is gradually giving way to a "polytony" of varied babbles. The repetitive aspect tends to disappear and combination takes the form of "mixing" several different babbles. We may understand how this "mixing" of varied babbles, in conjunction with the tendency to concatenate babbles and sometimes to smoothen transitions, may eventually lead to the fluent but highly incomprehensible (from a segmental point of view) productions of the subsequent period of jargon babbling. Also, we may interpret the mixing, concatenating and smoothening tendencies as the expression of an attempt at approximating some global aspects of adult speech, i.e. its fluent and varied character. In fact, during stage 3 I noticed the first clear instances of "imitation", which consisted of an echoing by the child of babbles from his own repertoire when I presented them. During the first two stages this type of imitation had been conspicuously absent[4].

The last, but certainly not the least important, development in this period concerns the discovery of the dimension of stress. Table 6 presents a transcription of a complete babbling episode in which the most important topic seems to be the systematic varying of the position of primary stress. /bɑ̃gəbɑ̃gə/ sequences are regularly alternated with /məgəməgəm/ sequences. A similar phenomenon could be noted when, long after sequences of the type /ləgəjləgəj/ had been firmly established, I frequently noticed sequences like /lɪgəlɪgə / or / jɪgəljɪgəl /[5]: Here, the same change in stress position may be observed.

Stress displacement may be regarded as another preparatory mechanism for the subsequent period of jargon babbling, during which sentence-like intonation patterns are prominent. However, I suggest that stress displacement may have yet another function, i.c. may also play a role in the "shaping" of new kinds of babbles. The separate babbles /bu:/ and /wɑ/ may be the result of differentiation of /bu:wɑ/ into its component parts. /bu:wɑ/ in its turn seems to be the result of applying stress displacement to /bwɑ/. /bwɑ/ becomes /bwwɑ/. The greater force on the /w/ component makes it easier to shape this sound into another one, i.e. the new vowel /u:/. The motivating force in this shaping process may arise from the same imitative tendencies as were mentioned above; the child may by now not

only have acquired representations of global aspects of adult speech, but may also have developed some auditory "images" of specific adult sounds, which he tries to approximate using his own babbling repertoire for a starting point. If we look at the process in this way, the mechanisms underlying the phenomenon of "babbling drift" (i.e. the fact that babbling begins to sound more and more like the mother tongue) may be better understood. Stress displacement followed by shaping and/or differentiation may be one of the ways in which "babbling drift" is caused. The foundation for this speculation is rather shaky however, since the observations on which it is based are so few in number.

In summary, during the last stage of repetitive babbling the child seems to be preparing himself to take off for the subsequent stages of jargon babbling and first words. Babbling sequences become more mixed in composition, lots of new concatenations arise and transitions between babbles become more fluent. The possibility of lateral movement of the tongue is discovered. The variation strategy is applied to two new articulatory dimensions: Place of articulation and Stress. The combination strategy takes on the new aspect of mixing varied babbles. Possibly a new kind of strategy, i.e. differentiation and/or shaping, arises which may be interpreted as resulting from a growing tendency to imitate aspects of adult speech.

3.4. Jargon babbling and first words

When jargon babbling appeared I stopped recording. This had several reasons. Firstly, babbling now often was completely unanalyzable by ear, secondly the child had become so mobile as to make recording quite complicated, thirdly I had an implicit naïve idea that, now that jargon had appeared, repetitive babbling would be over. This, however, was not the case. Two types of babbling now were to be observed; incomprehensible jargon and comprehensible repetitions. When the first words appeared there were three types of "babbling"; meaningful babbles, jargon and repetitions. Repetitive babbling seemed to be developing further along its own lines. For instance, in the jargon period /bùːwɑ/ was still produced frequently, but also a new babble /jIgəljIgəl / etc. (see 3.3) appeared. In the first words period the new babbling sequences / bubɑbubɑ/ etc. and /kukɑkukɑ / etc. were produced frequently. This suggests that repetitive babbling continues to be used for delineating and exercising new concepts

(for instance; the distinction between two vowels) and may not simply be regarded as a "relic" from the preverbal period. It is not surprising then that the first words tended to fit the babbling patterns remarkably well. These words were "kɑ", or "gɑ", said with rising intonation and accompanied by a pointing gesture, which I took to be an imitation of the Dutch word "kɛ.ik" (look), and "ɑp" (or "ɑ̀ppə","ɑ̀bə", "hɑp"), said when hungry, when eating or drinking, or when looking at food or at eating people, which word I took to be an imitation of the Dutch word "hɑp" (bite). A third word was /brr/ (the bilabial trill), which the child said when playing with toy cars, when pointing at cars in the street or when looking at pictures of cars. Although the Dutch word for car, "ɔuto", was frequently said to him in these contexts, he at first preferred the onomatopoeic bilabial trill (which I used to produce when making his toy car ride). This word simply is an existing babble having acquired meaning. A similar tendency could be observed in his word for "pus" (pussycat). At first he said /bəx/, which was an existing babble, then he said /bux/ and finally /bus/ or /pus/.

4. Discussion

The picture which emerges from this case study is one of a very systematic and continuous process of exploration. During repetitive babbling the possibilities of the articulatory organs are gradually brought under conscious control. Almost all of these possiblities have already been "used" in a more or less random way during the preceding period from 0 to ± 6 month's (Vander Stelt 1979), but now the child is exploring them in a far more goal-directed fashion. He hits upon two articulatory dimensions, Voice and Closure, and starts investigating their interrelationships and their limits. In so doing he hits upon another dimension, Duration, and he observes the differing effects of the varying of this dimension on those of Voice and Closure. Closure is differentiated into short, complete and prolonged, incomplete closure. The child starts concatenating his babbles in various ways. As a result of some of these concatenating activities he discovers the articulatory dimension of Place. The possibility of "lateral movement" is discovered as well. Babbles grow more complex and varied in character. Preparatory mechanisms for jargon babbling arise;

i.e. a still greater variety of concatenations appears, babbling sequences tend more and more to contain mixed instead of repeated concatenations, the dimension of Stress is varied. Jargon babbling appears but repetitive babbling continues and develops. When the first words appear, a relationship with existing babbles is evident.

When we look at this continuously developing process we observe that the child's productions gradually acquire more and more characteristics of adult speech. The way in which this happens however, may neither be satisfactorily characterized as "random exploration" nor as "imitation". Random and imitative aspects certainly may be discerned, but they appear to be subordinated to what may essentially be characterized as quite systematic and autonomous process of concept formation.
Lack of sufficient control over the articulatory muscles may account for some random variation in the way different instances of the same babble sound. Yet all these instances may easily be interpreted as belonging to the same type of articulatory act, and this is what counts. Also, when in the last stage of repetitive babbling the child starts "mixing" various babbles, there may be a random element in the way he chooses babbles from his repertoire, but it is the act of mixing, not the way it is performed, which counts. Similarly, in the last stage of repetitive babbling some imitative tendencies may be suspected to arise. Yet it is only in this final stage that they may be noted. Furthermore, their form is rather abstract. The child seems to be incorporating certain global characteristics of adult speech into his own babbling sequences, but immediate and direct attempts at echoing this adult speech are still absent. So even though adult speech may be acquiring a distant model function, babbling behavior still is largely determined by its own operating principles.

These operating principles or strategies are principally of two kinds; a variation strategy and combination strategy. The variation strategy consistsof the varying of an articulatory dimension in order to observe "what happens". It often leads to the discovery of new concepts or conceptual distinctions. This strategy confers to repetitive babbling its systematic character in that quite often the varying of a certain dimension may be seen to be the "topic" of an entire babbling episode. The Combination strategy consists of the combining of articulatory acts which previously have been exercised in isolation. This strategy leads to the creation of progressivelymore complex babbles and babbling

sequences, expressing itself successively in repetition, concatenation and mixing of babbles. Both strategies have interesting analogues in the general process of early skill development. Bruner (1973) for instance, describes how early grasping behavior progresses by the combining of skilled routines that have first developed separately (cf. combination strategy), and how the infant may apply different acts such as pounding, stroking etc. to the same object or subject different objects to the same act (cf. variation strategy). In babbling, the combined effect of the variation and the combination strategy is a growing number of different types of babbles with a growing level of complexity. Still the total number of different types of babbles is astonishingly small. Babbling in this period certainly is extremely "repetitive". Although the disposition to babble may be innate and biologically determined, nevertheless babbling means working hard and laboriously in order to achieve control.

A theoretically interesting question of course concerns the generality of the results from thiscase study. If repetitive babbling indeed is as systematic and autonomously developing as is argued, then we should expect the general developmental trends to be universal. Of course, we would not expect to find the same babbles in all infants, nor the same amount of babbling, but we would expect to find the same strategies operating and the same concepts formed. So other detailed case studies concerning the development of babbling, or rather concerning the development of "behavior involving the articulatory organs", are needed.

Another area of research indicated by this case study is the nature and development of babbling during the period of early speech, and its relationship to early language acquisition.

A third question concerns the point in babbling development at which deaf infants leave off. Our case study suggests that the concepts formed during the first two stages of repetitive babbling are primarily articulatory in nature. The hearing child, practicing these articulatory concepts, will establish articulatory - acoustic links which eventually, in the third stage of repetitive babbling, will play a role in his attempts to approximate certain aspects of adult speech. The deaf child will not be able to acquire these articulatory - acoustic links and so will never reach stage 3 on his own. If sufficiently motivated to keep on investigating the possibilities of his articulators however, he might be able to acquire the articulatory concepts of stage 1 and 2. Some support for this hypothesis

may be found in Lenneberg (1967, p. 139) when he informs us that "(...) many of the deaf children, during their spontaneous babbling, would produce sounds that were well articulated speech sounds such as pakapakapaka (...). The deaf had a tendency to engage in certain types of noise more persistently, whereas the hearing would tend to go frequently through a wide range of different types of babbling sounds as if to run through their repertoire for the sheer pleasure of it." In our terminology this suggests that Lenneberg's deaf children reached the stage 2 process of "concatenation" ("pakapaka" has a lot in common with "begebege" from our case study; the dimension "Place" is varied), but did not reach the stage 3 proces of "mixing" various different babbles. It is well known that infants generally are fascinated by the facial movements of their caregivers. The question whether deaf infants might be stimulated to go beyond stage 2 in babbling, with the help of such visual aids, deserves investigation.

The case study reported has resulted in a quite extensive plea for a cognitivistic "continuity" theory of repetitive babbling. So finally, a few words must be said concerning the objection against continuity theory that children often babble sounds which they later cannot produce in early speech. If we are sufficiently aware that in repetitive babbling the developing concepts are primarily motoric in nature and that one concept may be expressed in what to adult ears appears to be a cluster of several phonemes (for instance, the concept of "lateral movement of the tongue" in the phoneme cluster /dla/), it is not surprising that in later stages a certain component of such a cluster cannot be individually produced if it has not yet been differentiated (for instance, the /l/ part from the cluster /dla/). In investigating babbling it is very important to take notice of the contexts in which individual "speech sounds" occur. This fact often has been disregarded.

Another objection against continuity theory has been the observation that the occurrence of babbling may be prevented without noticeable detrimental effect. This suggests that babbling cannot be regarded as a practice stage for future speech acquisition. Lenneberg in this connection cites the case of a tracheotomized child who, after the tube had been removed from his throat, "produced the babbling sounds typical of the age" (Lenneberg 1967, p. 140). However, if successive developmental stages may be shown to be present in babbling, then observations like "typical of the age" are much too unspecific to be conclusive. In that

case babbling cannot be regarded as a unitary phenomenon, and we will have to look at "stage" instead of "age". We will have to know in which stage the child stopped babbling and in which stage he took up again. We will have to know whether the child was able to perform certain articulatory "non speech" activities in the meantime. On the basis of the case study reported it seems quite unlikely that a child should be able to take up at a considerably further advanced stage than that at which he left.

Notes

1. Jakobson's theory that the child is acquiring contrasts is supported by these observations (Jakobson 1968). The contrast in question however, seems to be still more extreme than that between /p/ and /ɑ/, which Jakobson regards as the strongest contrast possible and the first one to be acquired. In producing a /p/ only the oral cavity is shut off by closure, but in "holding the breath" the nasal cavity is shut off as well.

2. The "nasal" babbles /mamɑ / and / nənə/ were highly context dependent. They were produced almost exclusively at moments in which the child felt some sort of distress; hunger, thirst, need for attention etc. So they were mostly to be heard in combination with crying and whimpering. This often resulted in a convincing picture of a child calling for his mother. However, it seems clear that the /mamɑ/ and /nənə/ sequences had no "meaning" but resulted from a carry over of the nasal sounds of whimpering to babbling. In fact, when the child was about 14 month's old, the /mamɑ/ babble had almost disappeared in these contexts. The child by that time had perfected a kind of intentional whimper for expressing his distress. Jakobson (1971) sees the sucking activities of the infant, which are often accompanied by "a slight nasal murmur", as the origin of the /m/ sound. This may be true, but my observations suggest that the /m/ sound may also arise from the natural nasality of whimpering.

3. This must not be interpreted to mean that the child is discriminating in his production between "voiced closures" like /b/ and "unvoiced closures" like /p/. There is no evidence that differentiation of the concepts of Voice and Closure has proceeded that far.

4. During the first two stages I noticed I had a strong tendency for imitating Thomas' productions while he himself showed hardly any imitative tendencies. We had many "babbling conversations", but it was me who joined him and not the reverse. During the third stage however, Thomas was able to "join me", in the way described.

5. These latter babbles unfortunately do not appear on the recordings, so the reader will have to trust my memory.

6. Very probably we also must include Pitch in the list of systematically varied dimensions (see Delack 1976). As is mentioned in the Method chapter however, I choose not to include the aspect of pitch in my analysis.

Table 1

6-7 month's	ɐ, ːə, bvv, ggg	stage 1
	"vowel stammer"	
	gɑ	
7-8 month's	hə	
	bɑ	stage 2
8-9 month's	kxx	
	dɑ	
	mɑ	
	nə	
	brr (bilabial trill)	
	pff	
9-10 month's	gɑx	
	bɑpf	
	dzz	
	bwɑ	
10-11½ month's	dzzɑ	
	dlɑ	stage 3
	bügə	
	dləgɑj	
	bügəmbvv	
	bu:wa	
	bu:, wa, kxɑ, bəx, məx, bwagəx, həww	

Table 1: All types of babbles produced during the period of repetitive babbling, in order of appearance. Except for "vowel stammer", no type had disappeared at the end of this period. Each type is represented with its characteristic vowel sound. Babbling types represented with an /ɑ/ or /ə/ vowel could also be produced with vowels sounding like /a:/, /ü/, /ɛ/, /ɪ/, or /I/. Babbling types could vary as to amount of reduplication (bɑ, ɑbɑ, bɑbɑbɑ etc.) and as to voicedness of the consonant (bɑ, pɑ, bɑpɑpɑ etc.).

Table 2

hə, hə, hə, hàhə (....) hà, hàbə, hàbə , p (....) bəbàbə (....)
əpf, pfpfpf, əpf, (....) àbə, əbà, əbà (....) pfff, ppfff (....)
hà (....) à(....) əbà (....) bɑbàbə (....) əbvv,ɑ,ɑ, bə, bə, əbà (....)
pfff (....) p, p, p, (....) pfff, pəpff (....) əbà, əbà, əbà, bə (....)
a:a:a:a:, a:a:a:a:a:b, a:a:a:a:a:a:, a:a:a:a:, a:a:a:a:a:bwàbə (....)
bə, bə, bə, (....) əbà, bə, bə, bə, bə, əbà (....) ɑ (....) ɑ (....)
bɑbɑbɑbɑba:a:a:a:a: (....)ɑbàbə (....) p, p, p, p, pfpfff (....)
əbà, əbà, əbà (....) p (....) bvvwàbə, əbə, əbà, əbà, àbə, (....)
bə, bə, bə, bə, bə (....) a:a:a:a:a:a: (....) bə, ɑ, ɑ, ɑ, ɑ (....)
bə, bə, bə, bə, bə, bə, bɑ (....) b, b, b, b, ə (....) bàbɑbɑ (....)
bɑbɑbɑbàbɑbɑ (....) xxxx, bə, bə, bə, əp, p, əbà, p, p (....)
bəbəbwəbəbə (....) p, p, pfpfff (....) pfff, a:a:a:a:, a:a:a:a:a:bə(....)
bə, p, p, (....) ɑbà, p, p, p, p, pf, pf, pf, pf, pf (....) hà, hɑpf,
pf, pf, bə, p, pɑ

Table 2: Babbling episode recorded at 9 month's and 4 days.
Pauses are signified by (....); comma's between babbles signify
that they are produced disconnectedly.

Table 3

gə, tə, gə, ɑgə, ɑgə, ɑgəgəkə, ɑgəgəgə, ɑɑk, əgə, gɑ, əgə, gə, ɑgɑ, ɑgɑ,
gə, ɑgə, ɑgə, ɑgə, ɑggə, ɑgɑ, gɑ, ɑgɑ, ɑgə, ɑgɑ, ɑgəgɑ, gəgɑ, əgə,
əgə, ɑgɑ, ɑgə, ɑgɑ

dɑ, da:a:dɑ. da:a:tɑ, da:tɑ, dɑtɑ, tɑtɑ, dɑtɑ, tɑtɑ, tɑtɑ, tə, tə

kəkɪə, əkə, əgɑ, əgɑ, ɑgɑ, gə, gə, əgə, əgə, əgə, əgə (....)
xxx (....) a:gə

ɑgɑ, əgɑxx, gəgɑxx, gəgəgɑkɑgəgəgə, əgəxx, əgɑxx, əgəgɑxx, əgəgɑ,
gəgə, gəgə, ɑgəkə, gɑxx, əgəkɑkɑxx, gəkəx, əgəgə, gəgəxx

Table 3: Four babbling sequences from a babbling episode which was recorded at 9 month's and 20 days.

Table 4

pɑpv̀vv, ədə̀, mm, mə,əbə̀, əbɑ̀, ɑbɑ̀bɑ, ɑbɑ̀, bɑ̀, ɑbɑ̀bɑbɑ, ɑbɑ̀,
bɑbɑ̀x, pɑ̀pɑp, pɑ̀pəpvvv, pɑpv̀vv, əbv̀vvv, bvvv, pvvv, pvvv, bɑpv̀vv, bvvv,
əbvvv, pvvv (....) tsss, tsss, mmm, mmm, (....) hətətə (....) kxxx (....)
bɑ̀x, bɑ̀bɑ, pɑpɑpv̀vv, bvvv, ɑpɑpv̀vv, bɑbv̀vv (....)ədədzz̀z, ətss̀s, (....)
sss, sss (...) sss (...) pɑ̀pvvv, pɑpv̀vv, pvvv, bɑx, gɑgəx, gɑgə̀, əgɑ̀,
əbɑ̀, ba:bɑ, pɑpɑ̀pvvv, pvvv, pvv, əgə̀k, bɑbɑbɑ̀bɑpvvv

Table 4: Babbling episode recorded at 10 month's and 2 days.

Table 5

dzzz, dIzzz, tIdzzz, tItətItItItədŭ, dzzz, tIdzz, dədədəd, dədə,
dzzzɑ̀, dzzzɑ̀, hɑdzzjɑ̀ (....) bwww, bwww, bwww, bɑ̀bɑ(....) a:a:a:a: (....)
dlɑdlɑdlɑdlɑ (....) dlɑ̀jdlɑ̀jdlɑ̀j (....) dləgɑ̀jdliɑ̀jdliɑ̀j (....)
ɑjləgɑ̀jləgɑ̀jləgɑ̀jlə (....) ləgɑ̀jləgɑ̀jləgɑ̀jləgɑ̀jləgɑ̀jləgɑ̀ (....)
bu:, bù:wɑ (....) bù:wɑ

Table 5:Babbling episode recorded at 10 month's and 21 days.

Table 6

məgɑ̀məgɑ̀məgə̀ (....) əmɛŋəmɛŋəmɛx (....)
mm, mm,ɑməgɑ̀məgə̀ (....) bükəmbükəmbükəm (....)
bɑbɑməgɑ̀məgɑ̀məgɑ̀məgə̀, ə, ɑ, brrr (....)
mm, mmm, mmm (....) yodeling (....) ɑgùgùwɑ (....)
məgɑ̀məgɑ̀məgɑ̀mə (....) pap (....)
hɑ, bükəbükəbükəbük, bəkbrrr, brrr, bükəbükəbrr, brrr (....)
squealing (....) məgɑ̀məgɑ̀məgɑ̀m, ə, ə, ə, yodeling (....)
hə, hə, hɑ, hɑ, wɑ, hə, hɑ, hɑ, yodeling (....)
ha:a:a:, ha:a:a:, həəə , həəə , hə, hə, ɑbɑbükəbükəbükəm

Table 6: Babbling episode recorded at 11 month's and 15 days.

References

Bloom, L.: Language development; Form and Function in emerging grammars. Cambridge, Mass.: The M.I.T. Press, 1970.

Brown, R.: Words and Things. Colence, Ill.: Free Press, 1958.

Brown, R.: A first language, the early stages. Cambridge, Mass.: Harvard University Press, 1973.

Bruner, J.S.: Organisation of early skilled action, Child Development, 44, 1-11, 1973.

Clark, H.H. and Clark, E.V.: Psychology and Language; Harcourt Brace Javanovich, 1977.

Cruttenden, A.: A phonetic study of babbling, British Journal of Disorders of Communication, 5, 1970, p. 110-117.

Delack, J.B.: Aspects of infant speech development in the first year of life. Canadian Journal of Linguistics, 21, 17-37, 1976.

Gruber, J.S.: Playing with Distinctive Features in the Babbling of Infants. In: Ferguson C.A. and Slobin D.I. (Eds.), Studies of Child Language Development, Holt. Rinehart & Winston, 1973.

Jakobson, R.: Child language, aphasia and phonological universals. The Hague: Mouton, 1968.

Jakobson, R.: Studies on Child Language and Aphasia; Mouton, The Hague-Paris, 1971.

Lenneberg, E.: Biological foundations of language. New York: John Wiley & Sons, 1967.

McNeill, D.: The acquisition of language: The study of developmental psycholinguistics. New York, Harper and Row, 1970.

Mowrer. O.H.: Learning theory and symbolic processes. New York: John Wiley & Sons, 1960.

Oller, D.K., Wieman, L.A., Doyle, W.J. and Ross, C.: Infant babbling and speech. Journal of Child Language, 3, 1-11, 1976.

Schaffer, H.R. (Ed.): Studies in Mother-infant Interaction; Academic Press, 1977.

Schlesinger, I. Production of utterances and language acquisition. In: D. Slobin (Ed.), The ontogenesis of grammar. New York: Academic Press, 1971.

Snow, C. and Ferguson, C. (Eds.): Talking to children: Language input and acquisition. London: Cambridge University Press, 1977.

Van der Stelt, J.M.: Fonetiek en Spraakontwikkeling, Logopedie en Foniatrie, 51, 1979, 243-257.

Waterson, N. and Snow, C. (Eds.): The development of communication; Chichester, Wiley, 1978.

Weir, R.: Language in the crib, Mouton, The Hague, 1962.

Winitz, H.: The development of speech and language in the normal child. In: R.W. Rieber and R.S. Brubaker (Eds.), Speech Pathology, Amsterdam, Norht-Holland Publishing Co., 1966.